N83447.AR.000102
NAS FORT WORTH
5090.3a

DRAFT FIELD SAMPLING AND ANALYSIS PLAN FOR GROUNDWATER REMEDIATION AT LANDFILLS 4 AND 5 AT AIR FORCE PLANT 4 WITH TRANSMITTAL LETTER NAS FORT WORTH TX

3/1/1993

INTERNATIONAL TECHNOLOGIES

File: 17G
A.F.

NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 133

File:
D.B. 17A-53

INTERNATIONAL TECHNOLOGY CORPORATION

Project No. 305895
March 1993

Draft Plan

Field Sampling, Analysis and Testing Plan Groundwater Remediation Landfills 4 and 5 (Carswell) Air Force Base Plant 4 Fort Worth, Texas

Contract No. DACA56-92-D-0008
Delivery Order No. 0013

Prepared for:

Department of the Army
Tulsa District, Corps of Engineers
Tulsa, Oklahoma

Prepared by:

IT Corporation
Monroeville, Pennsylvania

In Support of Emergency Groundwater Remediation for AF Plant 4.

INTERNATIONAL TECHNOLOGY CORPORATION

March 26, 1993

305895-ITCHO-0007

Mr. Clif Warren, CESWT-EC-TRA
Department of the Army
Tulsa District, Corps of Engineers
224 South Boulder
Tulsa, Oklahoma 74121-0061

Contract: DACA56-92-D-0008, Delivery Order 0013
Air Force Plant 4, Landfills 4 & 5

Subject: Transmittal of Draft Field Sampling Plan

Dear Mr. Warren:

In accordance with the requirements of the subject Contract and Delivery Order, IT Corporation (IT) is pleased to submit the subject Draft Field Sampling Plan for your review.

Should you have any questions regarding this submission, please do not hesitate to contact the undersigned at (412) 372-7701.

Sincerely,

Vic Dozzi
Project Manager

Attachments

cc: G. Schwartz (ltr. only)
J. Weatherly
T. Winn (ltr. only)
J. Lopez (ltr. only)
Peggy Grubbs (COE - Ft. Worth)(1 copy)
Fred Oelrich (Air Force - Ft. Worth)(1 copy)
Lance Key (Carswell AFB - Ft. Worth)(1 copy)
File 305895

FIELD SAMPLING, ANALYSIS, AND TESTING PLAN

GROUNDWATER REMEDIATION OF LANDFILL 4 AND 5 AREA (CARSWELL) AIR FORCE PLANT NO. 4 FORT WORTH, TEXAS

T

F

A

R

D

Prepared for:
Department of the Army
Tulsa District, Corps of Engineers
Tulsa, Oklahoma

Prepared by:
IT Corporation
2790 Mosside Boulevard
Monroeville, Pennsylvania

IT Project No. 305895

Table of Contents

Table of Contents *(continued)*

DRAFT

List of Tables

List of Figures

1.0 Introduction

This Field Sampling, Analysis, and Testing Plan (FSATP) has been prepared as a portion of the submittal requirements for the Phase I groundwater remediation in the Landfill 4 and 5 (Carswell) (LF4 and 5) of Air Force Base Plant 4 (AF4) in Fort Worth, Texas. This FSATP includes the procedures necessary for the installation of recovery wells in the LF4 and 5 Area and testing of their capabilities. The activities has been derived from the scope of work in the IT Corporation (IT) proposal, Proposal No. C05839-004, submitted to the U.S. Army Corps of Engineers (USACE), Tulsa District in January 1993.

This FSATP is one of three documents prepared addressing the scope of work to be done in the LF4 and 5 Area. Companion documents are the project Contract Quality Control (CQC) Plan and the Health and Safety (H&S) Plan. These documents cover other aspects of the project and are required for full understanding of project controls and procedures.

1.1 Project Background

The LF4 and 5 Area at AF4 to be investigated as part of the work scope is a small portion of the total area of AF4 and is located on the eastern side of Carswell Air Force Base Taxiway 191. Figure 1 shows the general location of this area. Previous investigations have shown this area to contain unconsolidated sediments (upper zone) with trichloroethylene (TCE) contamination. Based on analytical data collected by Radian Corporation in 1990, the TCE contamination forms a narrow concentrated central plume paralleling a bedrock valley with the thickest portion of the upper zone sand and gravels, with a broader, lower-concentrated outlying plume moving in the direction of upper-zone groundwater flow.

1.2 Project Objectives and Phase I Scope of Work

The objective for the project is to contain and recover for treatment, groundwater in the LF4 and 5 Area that has TCE concentrations greater than 1,000 micrograms per liter (µg/L). This area is defined by the Spring 1990 groundwater quality data presented in the Radian Corporation Remedial Investigation (RI) Report (October, 1991). The eastern, hydrogeological downgradient extent of the plume with TCE contamination greater than 1,000 µg/L has not been defined. Therefore, the Phase I work will be focused on the Carswell Air Force Base golf course area immediately adjacent to and east of LF4 and 5 Area.

The Phase I scope of work for the LF4 and 5 Area groundwater remediation is to determine if a groundwater recovery well field will be an effective containment removal system. The secondary objective is to gather data to assist in the design of a water treatment plant, including flow rates and groundwater chemistry. To accomplish these objective, the Phase I scope of work involves the installation, testing, sampling, and analysis of three recovery wells within the LF4 and 5 Area.

To initiate the recovery of groundwater in the area of the highest historic TCE concentrations and thickest sand and gravel deposits, a submersible pump will be installed in Recovery Well CAR-RW2 and skid-mounted air stripper groundwater treatment system placed along White Settlement Road. The scope of work and requirements for this system will be presented under a separate cover during Phase II of the project.

DRAFT

2.0 Field Investigation Objectives and Approach

The Phase I field program, which includes recovery well installations, testing, sampling, analysis, is designed to provide site-specific data to allow for the sizing of a groundwater extraction system in the LF4 and 5 Area. The primary contaminant of concern for recovery is TCE.

The objectives of the field program are to:

- Determine recovery well yields from the upper zone aquifer in LF4 and 5 Area.
- Determine the quality of water discharge from the LF4 and 5 Area.
- Verify the original assumptions and approach for the groundwater remediation program, as described following:
  - Remediation area:
    a. The LF4 and 5 Area is not known.
  - The subsurface hydraulic conditions are:
    a. The hydraulic conductives and on slug tests ranged from 22.6 feet per day (ft/day) (7.98×10^{-3} centimeters per second [cm/s]) to 1.2 ft/day (4.1×10^{-4} cm/s). Based on the Radian Corporation aquifer pumping test in Monitoring Well LF04-03, the average hydraulic conductivity is 748 ft/day (2.8×10^{-1} cm/s).
  - The groundwater is contaminated mainly with TCE at 1,000 to 4,000 µg/L. In addition, some dissolved solids may have to be treated. It is assumed that these concentrations will remain relatively constant through the one year of operation.
  - As directed by the USACE the groundwater extraction and treatment system will be designed for the removal of dissolved TCE.

3.0 Field Test Organization and Responsibilities

Field activities will be conducted under the supervision of the IT Project Manager (PM). The PM has overall operational responsibilities involving execution and direct management of the technical and administrative aspects of the project. Field investigations and sampling activities will be performed under the direction of the Site Supervisor (SS). Responsibilities of the SS are described below.

3.1 Site Supervisor

The SS will have overall responsibility for completion of the field activities conducted at the facility. The SS will be the overall coordinator of the specific activities at the site and the communication link between field team members and the PM. The SS will assign specific field duties to team members (in conjunction with the IT PM). The SS will coordinate and oversee all subcontractor activities on the site. The SS will coordinate mobilization and demobilization for the sampling team as well as for any subcontractors. The SS will be on site during all specified field activities, oversee operations, and direct the activities of specified subcontractors on site. The SS will be the main point of contact in the field with USACE and Carswell Air Force Base personnel. Any resource problems hindering field activities such as equipment malfunctions or availability, personnel conflicts, or weather-dependent working conditions will be relayed to and resolved by the SS in conjunction with the IT PM.

The SS will also check the completion of Request for Analysis (RFA) and Chain of Custody (COC) Records, packaging and shipment of samples, and sample collection log entries for accuracy and compliance with laboratory protocols. The SS will check the field activity daily logs (FADL) and other field data forms for accuracy and compliance with the CQC Plan and FSATP. After review of the documentation, the SS will be responsible for storing and forwarding the documentation for PM review and filing in accordance with appropriate document control and security measures. The SS may direct or participate in field activities as appropriate when this does not interfere with primary responsibilities. The SS will initiate and execute all contact with support facilities and personnel when this action is appropriate. The SS will maintain contact with the USACE or its designated contractor to resolve logistical issues on site.

If a H&S representative is not present on site, the SS will act as the H&S representative. The H&S representative will be responsible for daily supervision and documentation of safety, decontamination, environmental monitoring, and other field monitoring activities as described in the H&S Plan.

The H&S representative has stop-work authorization that can be executed upon determination of an imminent safety hazard, emergency condition, or other potentially dangerous situations, such as detrimental weather conditions. Authorization to proceed with work will be issued by the H&S representative in conjunction with the IT PM after such action.

The H&S representative will also be responsible for designating and marking restricted areas during various site activities and for redesignating those areas when it is appropriate to do so.

DRAFT

4.0 Field Procedures

4.1 Mobilization and Demobilization

This activity will consist of field personnel orientation, equipment and personnel mobilization, the staking of sampling locations, and demobilization. All field personnel will attend an orientation meeting to become familiar with the history of the site, H&S requirements, and field procedures.

Equipment mobilization will entail the ordering, purchasing, and, if necessary, fabricating of sampling equipment needed for the field investigation. Prior to mobilization to the site, a request will be made for a mark out of utilities in accordance with the H&S Plan.

Locations for the groundwater recovery wells will be staked at the start of the field activities. These locations will be measured from existing landmarks, and provisions will be made to accommodate site activities currently in progress. In accordance with the Health and Safety Plan, exclusion, contaminant reduction and support zones with the appropriate personnel decontamination stations well be established at each daily location.

A decontamination pad will be constructed at a location designated by the USACE, on a paved or covered surface. At the discretion of the USACE, a central decontamination area may be designated. The pad will consist of a liner, a sump to collect runoff from the pad, and planks to support the drilling rig without damaging the liner. The decontamination pad and sump will be placed so as not to intrude on any proposed drilling locations. The integrity of the decontamination pad will be inspected by the SS on a daily basis before any decontamination activity starts. At the end of each day of field activities, the SS will make sure that all debris, soil, and decontamination water have been removed from the pad and that the liner was not damaged. Decontamination fluids and solids will be stored in drums for later disposal. Drums will be labeled as to their contents and date collected. Storage location of drums will be directed by the USACE with input form the facility operator.

Final disposal of drummed wastes will be performed by IT following receipt of analytical results from the recovery wells and will be as directed by the USACE.

4.2 Field Documentation Log and Variance Forms

An integral part of the quality assurance/quality control (QA/QC) procedures for the field activities will be maintaining a FADL. A separate FADL will be completed each day for each location where work is performed. Information identified on the FADL will be obtained from recovery well installation sampling and testing activities and will be documented by the SS. Each sample collected will be recorded on a Sample Collection Log that includes the date and time of sample collection, sample method, bottle requirements, and analytical parameters.

Collection, identification, preservation, packaging, shipping, and storage as presented throughout this document are based on applicable U.S. Environmental Protection Agency (EPA) requirements. The analytical quality assurance (QA) program as presented in the CQC Plan will follow procedures described in Chemical Data Quality Management for Hazardous Waste Remedial Activities (USACE ER-1110-1-263) October 1990 and will include the appropriate use of field blanks, duplicates, matrix spike/matrix spike duplicates (MS/MSD), equipment blanks, and trip blanks. Chapter 8.0 of this FSATP presents the field quality control (QC) procedures.

Procedures cannot always be prepared which properly address all specific conditions encountered during a field program. Variances from approved operating procedures in the FSATP, the QA/QC program, or the H&S Plan will be documented on a Variance Form. The SS will chronologically maintain the Variance Forms on a Modification Log. A variance from the H&S Plan must be signed by the H&S Coordinator. Approval by the PM can be initiated on a verbal basis via telephone with follow-up signature. If a variance is directed by the client, it will be so recorded. In no case will a subcontractor initiate a scope modification without written approval of the administrative contracting officer or their assigned designee. The Modification Log will be kept on site until the field work is complete and will then be sent to the project files. Copies of field documentation forms are presented in Appendix A.

4.3 Field Documentation Forms

Field activities associated with recovery well installation and testing will be documented using the following forms:

- Visual Classification of Soils Log
- Sample Collection Log
- FADL
- RFA and COC Record
- Well Construction Diagram
- Monitoring Well Development Log.

H&S forms and QC forms will also be used as described in the H&S and CQC Plans. The following paragraphs provide additional information for each of the forms mentioned above.

Visual Classification of Soils Log. The site geologist will maintain a Visual Classification of Soils Log for each boring location. This log will serve as a record of boring location, depth, drilling procedures, and subsurface stratigraphy. Visual classification of soils log will be recorded on USACE's Engineering Geologic log ENG 1836. An example of a visual classification log is presented in Appendix A. The information contained in the log will include:

- Heading information including project number, site number, boring number, geologist logging the boring, horizontal and vertical coordinates, and the date the boring was started and completed.
- Drilling contractor (Driller will be licensed by Texas Water Commission [TWC]).
- Soil or rock descriptions including:
  - Major soil or rock component
  - USCS symbol (for soils)
  - Color
  - Visual contamination, if any
  - Other descriptive terms
- Organic vapor analyzer (OVA) or photoionization detector (PID) measurements.
- Depth/elevation of stratigraphic changes.
- Water table information and method of determination.

- Drilling equipment details.
- Drilling sequence and comments.

In addition to the Visual Classification of Soils Log, a well construction diagram will be prepared for each recovery well. The USACE soil boring log, the IT Visual Classification of Soils Log, and Monitoring Well Development Log will be presented in the Phase I field investigation report. The soil boring log, well completion log, along with a map showing the well locations will be prepared and sent to the Texas Water Commission (TWC) for filing within 60 days of well completion, in accordance with Chapter 287 of the Texas Administrative Code (TAC). The preparation and submittal of this material will be the responsibility of the drilling subcontractor under the direction of IT.

Request for Analysis and Chain of Custody Record. A single form for RFA and COC will be used for the groundwater samples collected. A brief description is provided below. The laboratory analysis request is to inform the laboratory of the testing program required for the collected samples. The following information is recorded on the laboratory analysis request form to supplement COC records:

- Request for testing program for each sample, including method number
- Sample volume collected
- Required report date and turnaround times for analysis
- Contact with telephone number for receipt of the analytical report and billing invoices
- Signatures indicating who has custody.

An example of a RFA/COC form is included in Appendix A.

Field Activity Daily Log. Field activities including sampling, field measurements, and screening will be documented on a FADL. The FADL will serve as the formal field

documentation form for field activities. The FADLs are prepared forms. Entries on the FADL will be made in water-resistant ink and will include, as a minimum:

- Date, time, and personnel present
- Documentation of existing weather conditions
- Field equipment calibration data and equipment identification number
- Field instrument measurements
- Unusual events
- Sample location and number
- A general description of the day's field activities
- IT personnel and visitors on site
- Communication with regulatory agencies, or others
- Changes to plans and specifications with reference to Modification Log
- Duration of construction equipment on site
- OVA or PID measurements.

Eventually, on completion of the project, all FADLs will be filed together as part of the permanent project records. An example FADL is shown in Appendix A.

Sample Collection Log. A Sample Collection Log is prepared for each sample to record information pertaining to the location, condition, and collection of a sample. The following information is required on the Sample Collection Log, as appropriate:

- Project name and number
- Date and time of sample collection
- Sample collection team members
- Sample identification number, location, and sample matrix
- Depth of sample
- Weather conditions
- Number and type of sample containers
- Quantity of samples collected
- Field measurements (e.g., pH, specific conductance, temperature, etc.)
- Organic vapor analyzer or photoionization detector measurements.

An example of an IT Sample Collection Log is included in Appendix A. Sample Collection Logs will be kept in the final project file to document collection of samples.

5.0 Recovery Well Installation

5.1 Recovery Well Locations

Recovery well locations were selected following review of site geology, hydrogeology, and analytical reports. Based on the size and extent of the observed TCE plume, the thickness of the upper layer, the stratigraphy of the upper layer, the groundwater flow within the upper layer, the bedrock topography, and the assumed dimensions of the LF4 and 5 Area, three recovery well locations were selected. These recovery wells were designated as Recovery Wells CAR-RW1, CAR-RW2, and CAR-RW3, and are shown on Figure 2.

The recovery well locations were chosen so the well screens would encounter the maximum saturated thickness and permeability of the upper zone within the main TCE plume. Recovery Well CAR-RW1 will be located approximately 50 feet south of Monitoring Well CAR-LF04-4H along the golf course service road. Recovery Well CAR-RW1 will have a total depth of approximately 28 feet and will encounter approximately 12.5 feet of saturated upper zone sands. Recovery Well CAR-RW2 will be located along White Settlement Road 20 to 30 feet from Monitoring Well CAR-LF04-4G. Recovery Well CAR-RW2 will have a total depth of approximately 42 feet and will encounter approximately 17 to 19 feet of saturated upper zone sand and gravel. Recovery Well CAR-RW3 will be located approximately 100 feet due west of Monitoring Well CAR-LF05-5G. Recovery Well CAR-RW3 will have a total depth of approximately 30 feet and will encounter approximately 12 feet of saturated upper zone sand and gravel.

The three recovery wells will be installed through the entire upper zone and will stop when bedrock is encountered. In no case will the recovery well advance into bedrock. A representative cross-section of the LF4 and 5 Area is shown in Figure 3. The location of these wells has been selected to allow for their incorporation into the recovery well field used to extract the TCE plume. The exact location of the recovery wells may change based on the location access, location of underground utilities, and the need to avoid or minimize impacts to golf course usage.

5.2 Soil Boring Procedures

Drilling will be conducted by a qualified drilling subcontractor under the direct supervision of an IT hydrogeologist. The drilling subcontractor will be licensed by the TWC as specified in Chapter 287 of the TAC. Borings in unconsolidated sediments will be advanced using the mud rotary drilling method.

The site hydrogeologist will maintain a Visual Classification of Soils Log of each soil boring. The log will serve as a record of boring location, depth, drilling procedures, and subsurface stratigraphy. The Visual Classification of Soils Log contents are described in Section 4.3.

Recovery well borings will be drilled using the mud rotary drilling method with a biodegradable mud, if necessary. Borings will be made with a minimum 12-inch-diameter bit to allow for placement of a sand pack around the well. A smaller bit may be used to drill a pilot hole prior to reaming with the 12-inch diameter bit. Borings will be advanced through the upper zone until bedrock is reached (approximately 30 to 40 feet). In all cases, bedrock will not be penetrated. If bedrock is encountered before the water table is encountered, the boring will be abandoned. Likewise, if the permeability of the saturated upper layer is insufficient for the installation of a recovery well (i.e., $<1 \times 10^{-4}$ cm/s, no sand or gravel), the boring will be abandoned. The approximate permeability of the formation will be determined by the IT hydrogeologist based on relative thickness and the grain sizes of the cuttings carried to the surface in the drill mud at each location. Abandoned boreholes will be filled with a cement/bentonite grout pumped to the surface of the borehole. If a recovery well location is abandoned, an alternate location will be selected by the IT hydro-geologist with the concurrence of the SS, the PM, and the USACE. The alternate location will be selected using the same criteria as the other recovery wells and will utilize any additional information gathered in the field. Following selection of the new location, the well will be installed using the same procedures as the other recovery wells.

All drilling muds will be drummed and stored for later disposal. Drums will be labeled as to their contents, date collected, and location drilled. Following completion of the boring and installation of the recovery well, all equipment used will be decontaminated as described in Chapter 10.0.

5.3 Well Construction Materials

The construction materials to be used for the well screens and casings consist of stainless steel. The selection of well screen and casing material was based upon the anticipated degree of volatile organic contamination, total depth of the well, chemical parameters to be encountered, and anticipated lifetime of the recovery wells.

Recovery wells will be installed using a 6-inch-diameter stainless steel casing and screen. Stainless steel screen must be preordered in 10 or 5 foot sections prior to drilling and can not be cut in the field. Stainless steel riser can be cut in the field. Therefore, based on the existing wells in the area and historic water level data the following screen sizes will be used:

- Recovery Well CAR-RW1 - 20 feet
- Recovery Well CAR-RW2 - 20 or 25 feet
- Recovery Well CAR-RW3 - 15 feet.

Based on existing well construction data the screen slot .020-inch continuous slot screen will be used. A 10 to 20 sieve sand filter pack will be used in the recovery wells.

The well design for recovery wells will use a sand filter pack to be placed around the screen from the bottom of the borehole to a minimum of 3 feet above the screen. To form a seal, the filter pack will be followed by 2 feet of bentonite pellets. The bentonite pellets will be followed by a cement-bentonite grout. The grout will be pumped to a depth of approximately 2 feet below the surface. The cement-bentonite grout will consist of a five percent bentonite cement. Field conditions can vary and lead to a change in actual well construction dimensions. Construction diagrams along with variance logs will be used to document changes.

A watertight, 12-inch-diameter flush mount will be employed to seal the well. The mounting will consist of a steel flush mount fitted with rubber gasket to create a watertight seal, and will contain a locking cap on the top of the well. The flush mount will be secured with cement that will extend to a depth of 2 feet into the borehole.

5.4 Recovery Well Installation Procedures

Recovery well installation will begin immediately after completion of the borehole and proceed continuously until the recovery well has been grouted into place. Prior to placing the protective casing, additional grout may be added due to settling. The standards developed by

the TWC under Chapter 287 of the TAC will be used as a guidance for construction of the recovery wells. Specific details of recovery well installation are as follows:

- The end of the recovery well screen will be capped with a threaded end cap. The well screen and riser will be inserted into the borehole one section at a time. All joints will be hand tightened.

- A removable cap will be placed over the top of the recovery well riser prior to filling the annular space around the well. This will prevent foreign materials from entering the well during well construction activities.

- A sand filter pack will be installed within the annular space around the well screen to form the recovery well pumping zone. The filter pack will consist of clean and washed bagged silica sand, graded accordingly for the recovery well screen slot size. If necessary, the filter pack will be installed by maintaining a head of water in the boring, using the downward flow of water to prevent bridging. Only potable water will be used. If water is added during well installation, the appropriate volume of water will be removed during well development.

- One to 2 feet of the sand filter pack will be placed in the annular space at a time and will be allowed to settle before placing the next 1 to 2 feet of sand. The sand filter pack will extend a minimum of 3 feet above the top of the recovery well screen.

- A 2-foot layer of bentonite pellets will be placed above the sand filter pack and will be allowed to swell and seal the borehole. Only clean, potable water will be added to induce swelling, if necessary.

- The annular space around the riser will be tremie grouted from the sand filter pack layer to within 2 feet of the borehole surface with a cement-bentonite grout.

- The remaining 2 feet of the annulus will be used for the cement that secures the flush mount casing.

- All depths to, and thicknesses of, materials will be recorded. A weighted measuring tape or tremie pipe or drill rods of known and accurate length may be used to determine these depths.

- The riser pipe will be cut 3 to 6 inches below the ground surface so a watertight, steel flush-mounted protective outer casing can be installed and cemented in

place around the well casing. The cement apron around the flush-mounted casing will be sloped so surface water runs off the well.

5.5 Recovery Well Development

Upon completion of recovery well installation, each recovery well will be developed to remove fines from the well to provide a particulate-free discharge and to restore the natural hydraulic conductivity of the formation. Recovery well development will occur no earlier than 48 hours following the cement/bentonite grouting phase of the well construction. Recovery wells will be developed through a combination of gentle surging, bailing, and pumping. In this manner, flow reversals within the well may be created, thereby eliminating the possibility of bridging of fine particles against the well screen. Temperature, pH, specific conductance will be measured and recorded during development to determine when sufficient water has been removed. Odors and visually determined turbidity will also be noted. A Monitoring Well Development log will be used to record the measurements and observations. In addition to any water added to the borehole during well installation, a minimum of three well volumes will be removed during development. Recovery well development will be evaluated by pH, temperature, specific conductance measurements, and visual turbidity. Development water will be collected and stored prior in a frac tanker placed on site. This frac tanker and its later uses are described in Chapter 6.0.

5.6 Recovery Well Surveying

Following installation and testing of the recovery wells, the wells will be surveyed in by a licensed surveyor to within 0.1 foot horizontal using a local coordinate system and to within 0.01 foot vertical using mean sea level (MSL) elevations. These coordinates and elevations will be added to the well completion diagrams.

6.0 Recovery Well Step-Drawdown Testing

Testing of the recovery wells will be done utilizing step-drawdown tests to determine the specific capacity of each recovery well. The step-drawdown test consists of pumping each recovery well at several pumping rates, called steps, while monitoring the recovery well drawdown. Pumping at each rate is continued until drawdown in the well stabilizes, usually from 2 to 4 hours. The results of this test will be used to determine the optimum pumping rate from each recovery well. This will assist in the future sizing of the extraction well field and treatment system. Water level measurements will be taken in nearby monitoring wells prior to and during the step-drawdown test.

The step-drawdown tests conducted in each recovery well are anticipated to be of 8 to 10 hours' duration, with three pumping rates utilized. The three steps will be initially executed using two 3-hour steps followed by one 4-hour step at anticipated pumping rates of 10.0, 20.0 and 30.0 gallons per minute (gpm). These pumping rates are based on calculations of the expected drawdown in the recovery wells using aquifer hydraulic parameters extrapolated from previous aquifer tests conducted in the area. At the option of the IT-Hydrogeologist, the pumping rates and duration may be modified during the test. Groundwater samples will be taken for field and laboratory analysis at the end of each step as described in Chapter 7.0.

The procedures for the step-drawdown test are as follows:

- The recovery well's water levels will be allowed to recover for a minimum of 24 hours following well development.
- Prior to testing, all testing and sampling equipment will be decontaminated using the procedures described in Chapter 10.0.
- A pretest water level will be measured in the recovery well to the nearest 0.01 foot using an electronic water level indicator.
- A free product bailer will be used to determine the presence of dense nonaqueous phase liquid (DNAPL) in the well, prior to pumping.
- A downhole pressure transducer will be secured to the top of the pump, above the pump intakes.

- The pump and transducer will be lowered down the borehole until the pump's bottom is located approximately 2 feet above the bottom of the well. This will maintain the pump free of any silt and other particulates which may enter the well during pumping.

- The transducer will be connected to an electronic level head indicator.

- All outflow lines from the well will be laid out and inspected to determine their integrity. The outflow lines will be routed around traffic areas or blockaded off and will discharge into a holding tank.

- A flow meter capable of measuring flow rate and cumulative flow will be installed on the main outflow line from the pump to monitor discharge rates.

- The water level will be measured again to ensure a constant pretest level is maintained.

- The pump and level head indicator will be activated simultaneously and the flow rate of the pump adjusted to the pumping rate of the first step.

- The pumping rate will be increased and the data collection started at the same time.

During the testing, the flow rate of the pump will be monitored to maintain a constant flow rate. The discharge line will be visually inspected to determine its integrity during the test and will consist of flexible polyvinyl chloride (PVC). The pump used will consist of a stainless steel submersible pump capable of providing a range of flow rates from 10 to 30 gpm.

Following the conclusion of the test, all equipment will be shut off and removed from the well. All downhole equipment will be decontaminated as described in Chapter 10.0. Discharge lines located downstream of the side shunt valve will be reused for each test.

The estimated total volume of water resulting from step-drawdown tests in all three recovery wells will be 37,800 gallons. Two 20,000 gallon frac tankers will be set up on site at a location approved by the USACE. The discharge water will be stored in these tanks prior to its treatment in the groundwater treatment system.

7.0 Recovery Well Sampling

7.1 Recovery Well Sampling Procedures

The EPA 1986 Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document will be used as guidance for collection of groundwater samples. Recovery wells will be sampled at the end of each step during the step-drawdown testing. This will necessitate three sampling events per recovery well, for a total of nine samples. Table 1 lists the laboratory parameters to be analyzed. Field measurements of pH, specific conductance, and temperature will also be collected as described in Chapter 9.0.

Samples obtained from the groundwater recovery wells will be collected by means of a side-shunt valve. The recovery well will be sampled by slowly opening the valve at a low flow rate to transfer water to the sample container. Volatile organic compound (VOC) sample containers will be filled first and at a slow rate to minimize agitation and aeration of the water. Samples will be poured into the appropriate labeled sample bottles, sealed, and stored in a cooler with ice until final shipment to the laboratory.

7.2 Water Sample Identification

To prevent misidentification of samples, legible labels will be affixed to each sample container with sufficient information to uniquely identify the sample in the absence of other documentation. The labels will contain the following information:

- Project name and number
- Unique sample number
- Sample location (and depth, if applicable)
- Name or initials of collector
- Date and time of collection
- Preservation method employed
- Analysis required (if space on label allows).

The sample labels will always be directly affixed to the sample contained and will always be completed using indelible ink. Sample Collection Logs will be generated for each sample sent to the laboratory. These logs will be used to provide evidence for collection of the

sample and placed in the final project file. A security seal will be placed on the shipping containers to ensure the samples have not been disturbed during transportation.

7.3 Water Sample Documentation

Each sampling team or individual performing a particular sampling activity is required to fill out a Sample Collection Log. A Sample Collection Log will be filled out for each collected sample. The Sample Collection Log will contain sample particulars including:

- Project name and number
- Sample number (unique)
- Sampling location (e.g., boring, depth or sample interval, and field coordinates)
- Sampling date and time
- Individual performing the sampling
- Types of sample containers used
- Quantity of sample collected
- Preservation method employed
- Proposed analytical program
- Climatic conditions, including air temperature
- Sample observation (color, odor, etc.)
- Field observations.

7.4 Water Sample Custody

COC procedures are intended to document sample possession from the time of collection to disposal. An RFA and COC Record will be completed by the sampler at the time the samples are collected. This record then accompanies the samples at all times and is placed in the project file after final sample disposition. All transfers of custody will be documented on this record. For the purpose of these procedures, a sample is considered to be in custody if it is:

- In one's actual possession
- In view, after being in physical possession
- Locked so that no one can tamper with it, after having been in physical possession
- In a secured area, restricted to authorized personnel.

The RFA and COC Record documentation procedures are described in Chapter 11.0.

7.5 Parameter-Specific Water Sampling Procedures

Sample bottles will be prepared according to SW-846 specifications for sampling and will be provided by the laboratory performing the analysis. The bottles will not be opened prior to filling. All containers and preservation methods will be done in accordance with the CQC Plan Addendum.

Order of Sample Collection. Samples will be collected and containerized in the order of volatilization sensitivity of the analytical parameters as follows:

- VOCs
- Semivolatiles
- Total metals.

Volatile Organics. Sample containers for volatile organics will be completely filled. The bottles will be carefully filled so that no air is trapped in the sample container. Water will be slowly poured into the sample bottle to allow formation of a meniscus on the water surface at the top of the bottle. The sample lid and septum will be carefully placed on the sample bottle. Once the bottle lid has been secured, the sample will be checked for air entrapment by inverting the bottle, firmly tapping the bottle, and checking for air bubbles. If air bubbles are observed, the cap will be taken off and additional sample water will be added to the container. The procedure for checking for air bubbles will be repeated until no air bubbles remain.

Volatile organic water samples will be preserved with hydrochloric acid to a pH of two. Either sufficient hydrochloric acid will be added to the sample container in the laboratory prior to shipment of a separate sample and sample container will be used to determine the amount of hydrochloric acid needed in the field to achieve the appropriate pH.

Semivolatiles. Sample containers will be completely filled with unfiltered sample water.

Metals. Groundwater samples for metal analysis will be unfiltered. Sample containers will be completely filled. The unfiltered sample will be preserved in the field with nitric acid to a pH of less than two. A separate sample and sample container will be used to determine the amount of nitric acid needed to achieve the appropriate pH. The water used to determine the appropriate pH will be combined with recovery well purge water for handling.

Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). Sample containers will be completely filled with unfiltered sample water and chilled to 4 degrees Centigrade (°C) to minimize microbial decomposition of samples.

8.0 Sample Quality Control Procedures

To verify the performance of field sampling activities, QC samples will be collected for laboratory analysis. Field QC sampling will be established to check sampling and analytical accuracy and precision. All QC samples will be shipped according to the chain-of-custody procedures specified in Chapter 11.0. Field QC samples will include the following types of samples:

- Field QC duplicates
- Field QA duplicates
- Travel blanks.

Equipment blank samples will not be collected. Groundwater sample containers will be filled directly from the pump discharge. Sampling equipment will not be used.

Field QC samples will have discrete sample numbers and will be submitted to the laboratory. These samples will be analyzed as if they were original field samples. Results for these samples will be included in the analytical report. Table 1 lists the QC samples to be done for this project and their frequency.

Results for QC samples will not be used to adjust the results obtained for original samples. If contaminants are found in the blanks, attempts will be made to identify the source of the contamination and corrective action will be initiated.

8.1 Field Duplicate/Triplicate Samples

Field duplicate/triplicate samples are samples that are collected in multiple the original sample for each analytical parameter. Field duplicate/triplicate samples will be collected at a frequency of one per group of 10 or fewer investigative samples of similar matrix. The procedure for obtaining the duplicates and triplicates is identical to that for the original. The same container type, preservative, and sampling technique are used. The duplicate sample will be sent to the same laboratory as the original sample. The triplicate will also be collected by IT for analysis by a designated USACE laboratory at the same time and from the same location as the original and field duplicate samples are collected.

In order to maintain the representativeness of the samples, the original, field duplicate and triplicate sample containers will be filled alternately. For example, for volatile organic compounds (VOC) the original, duplicate, and triplicate vials will be filled alternately until the three vials for each sample are filled.

The original sample will have the sample name, i.e., CAR-RW1-1 on the label. The duplicate sample will have DUP in the sample name, i.e., CAR-RW1-1 DUP, and the triplicate will be installed with trip in the sample name, i.e., CAR-RW1-TRIP.

8.2 Trip Blank Samples

One trip blank sample which consists of two 40-milliliter (ml) glass vials shall be shipped with each cooler of VOC water samples. Trip blank samples are prepared prior to the sampling event in the actual sample containers and are kept with the VOC investigative samples throughout the sampling event. They are packaged for shipment with other VOC samples and sent for analysis. The sample containers are not opened until the time of analysis. Trip blank samples are used to assess potential sample cross-contamination during the shipping of the samples.

8.3 Laboratory Quality Assurance/Quality Control Program

A laboratory QA/QC program has been developed using SW-846 methods to meet the following objectives:

- Confirm that all procedures are documented, including any changes in administrative and/or technical procedures
- Confirm that all analytical procedures are conducted according to sound scientific principles and have been validated
- Monitor the performance of the laboratory by a systematic inspection program and provide for corrective action as necessary
- Collaborate with other laboratories in establishing quality levels, as appropriate
- Confirm that all data are properly recorded and archived.

All laboratory procedures are documented in writing as Standard Operating Procedures (SOPs) which are edited and controlled by the laboratory QA/QC Manager. Internal QC

procedures for analytical services will be conducted by the laboratory in accordance with its SOPs and the individual method requirements in a manner consistent with appropriate analytical methods. These specifications include the types of audits required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each audit, the compounds to be used for sample spikes and surrogate spikes, and the QC acceptance criteria for these audits.

The laboratory QA/QC samples will follow the requirements stated in the laboratory SOPs and will include:

- Laboratory matrix spike/matrix spike duplicate
- Surrogate standard analysis as appropriate
- Check and verification of standard analysis
- Method blank analysis
- Daily tunes and daily calibration
- Sampling dates, sample receipt date, extraction and analysis data.

8.4 Verification and Validation of Chemical Data

Verification of laboratory chemical data will be the responsibility of the laboratory performing the analyses under the supervision of IT. Verification of chemical data generated in the field is the responsibility of the SS. Validation of chemical data will be the responsibility of the USACE. Laboratory verification and validation sheets will be made available to the USACE upon their request.

8.5 Preventive Maintenance

Records of preventive maintenance of laboratory equipment will be maintained in the laboratory. This information is available for review during laboratory audit activities. A preventive maintenance schedule for any field equipment will be based on the manufacturer's specifications for the equipment and documented on field equipment calibration records.

9.0 Field Parameters

9.1 Field Equipment Calibration

Measuring and testing equipment used in the field shall be controlled by a formal calibration program. Table 2 lists the field sampling equipment calibration frequencies. Equipment of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and desired results will be used to record the field measurements. Responsibility for the calibration of field equipment and logging the results of the calibration rests with the individual performing the sampling. The SS will check and maintain field calibration logs for accuracy and compliance with the CQC Plan and FSATP. Instruments will be calibrated according to the manufacturer's recommended procedures prior to each day's sampling and readings will be verified and recorded on a FADL. The pH meter will be calibrated using three standard buffer solutions (normally pH 4, pH 7, and pH 10). Calibration of the specific conductance meter will be performed with calibration solution with various standard micromhos per centimeter (mhos/cm) values, at the beginning of each day of sampling activities and intermittently during use. Acceptable limits or ranges in calibration accuracy will follow manufacturer's standards. The probes used to determine field parameters that come in contact with the sample water will be decontaminated with a triple rinse of distilled water.

9.2 Field Analysis Procedures

Specific conductance, pH, and temperature of water samples will be measured in the field and recorded on the Sample Collection Log. Any sample odor and color will also be noted. These field parameters will be measured in sample aliquots collected after the laboratory volatile organic analysis (VOA) sample has been collected. Monitoring probes will not be placed in sample bottles containing samples for laboratory analysis. The field parameter samples will be handled along with the water generated during the step-drawdown test. The following sections detail the procedures to be used for field analysis.

9.3 Temperature

Summary of Method. Temperature readings are obtained by partially immersing a temperature probe into a sample vial will be filled. For layer sample containers (i.e.,

semivolatiles) the containers will be partially filled alternately two completely filled to ensure that the representative samples are collected.

Apparatus. A multimeasuring device is used with a normal range of 0 to 50°C.

Measurement Practices. Temperature readings should be taken immediately after VOC sample collection on unpreserved samples. The readings will be documented on field measurement or sample collection forms. On some instruments the temperature reading is used for correcting the specific conductance.

9.4 pH Specific Conductance

Summary of Method. The pH of water is normally determined by immersing a combination electrode (glass and reference electrode) in solution and measuring the potential difference with a pH meter.

Apparatus:

- Standard pH meter (battery operated) with an expanded scale capable of measuring pH to the nearest 0.1 unit
- Combination electrode
- Three standard buffer solutions:
  - pH 4.0
  - pH 7.0
  - pH 10.0.

Sample Measurement:

- Rinse electrode with deionized water.
- Transfer sample into a beaker.
- Insert electrode into the sample solution and let it equilibrate for few minutes. Stir the sample during measurement.
- Read the pH values on the pH meter to the nearest 0.1 unit

- Record reading on appropriate field data form.

Measurement Practices:

- Rinse electrode with deionized water between each measurement
- Make sure that the line cord is properly attached to the instrument
- Expose filling hole on the electrode by lowering rubber sleeve
- Electrode tip needs to be immersed only 1 inch to obtain accurate readings
- Never move or touch connecting cables during Ph measurement.

9.5 pH

Summary of Method. A conductivity cell is immersed in a sample of water and the conductance in mhos/cm is measured directly from the meter.

Apparatus:

- Conductivity cell or probe
- Conductivity meter.

Sample Measurement:

- Insert the probe completely into the sample
- Switch the meter to the appropriate scale and record the readings in mhos/cm
- Record all readings on the appropriate field data form
- Correct the specific conductances values for temperature using appropriate temperature correction factors.

Measurement Practice:

- Replace battery when the read line adjustment cannot be accomplished
- Rinse probe with deionized water between each measurement.

10.0 Equipment Decontamination Procedures

Decontamination of equipment for drilling and water sampling is provided in the following sections.

10.1 Decontamination of Drilling Equipment

Drilling equipment used on site, including the drill rig, water tank, bits, rods, and associated tools, will be decontaminated with a high-pressure steam cleaner prior to drilling the first borehole. Bits, drill rods, and associated tools will be decontaminated with a high-pressure steam cleaner prior to and between each borehole. Decontamination activities will be performed at an on-site location designated by the USACE or its contractor, as described in Section 4.1. The water used in the decontamination of drilling equipment will be supplied by the USACE from an on-site potable water source. The decontamination water will be collected and contained prior to later treatment by the USACE.

10.2 Decontamination of Sampling Equipment

Sampling equipment including bailers, pumps, and associated equipment will be decontaminated between sample wells either directly at the sample location or at the primary decontamination area. The decontamination area will be selected by the SS with the USACE's concurrence. The decontamination procedure for equipment used in collection of samples for chemical analyses will be as follows:

- Steam cleaned or wash in soapy water (a phosphate-free detergent)
- Rinse in potable water
- Rinse with methanol
- Rinse with distilled water
- Air dry.

After decontamination, the sampling devices will be wrapped in aluminum foil (shiny side out) or clean polyethylene plastic to prevent contamination during handling. The decontamination water will be collected and contained prior to later treatment by the USACE.

11.0 Chain of Custody, Sample Storage, and Shipment

The RFA and COC Record will be signed by each individual who has the samples in his or her possession, as described in Section 4.3. Field preparation of this record shall be as follows:

- The RFA and COC Record will be initiated in the field by the person collecting the sample. Every sample will be assigned a unique identification number that is entered on the record. Samples can be grouped for shipment using a single record.
- The form will indicate the project name, sampling team, laboratory destination, special instructions, and possible sample hazards.
- If the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for Relinquished By ____, Received By ____ will be completed in the field.
- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record as Relinquished By ____.
- If the samples are shipped to the laboratory by commercial carrier, the original RFA and COC Record will be sealed in a watertight container and placed in the shipping container. The shipping container will be sealed prior to being given to the carrier. A copy of the forms will be kept in the project files.
- If the samples are transported directly to the laboratory, the RFA and COC Record will be kept in possession of the person delivering the samples.
- For samples shipped by commercial carrier, the waybill will serve as an extension of the record between the final field custodian and receipt in the laboratory.

All samples will be packaged for shipment in compliance with current U.S. Department of Transportation (DOT) and commercial carrier regulations. All required government and commercial carrier shipping papers will be filled out and shipment classifications made according to current DOT regulations. Packaging of samples will be accomplished as follows.

As each sample is collected in the field, it will be placed in labeled bottles and stored in an iced cooler. Sample preparation will include properly labeling the bottles and storing the samples on ice at approximately 4°C. COC documents will be prepared in the field for all samples that will be shipped to a laboratory.

Sampling containers will be supplied and prepared according to sample type. Samples which will be shipped to the laboratory for analysis will be prepared for shipment using the following procedures (if appropriate, according to the sample shipment containers supplied by the laboratory):

- Tighten sample bottle lids hand-tight.
- Place about 3 inches of packing material in the bottom of a waterproof metals or equivalent-strength plastic cooler.
- Place bottles in clear plastic bags in the cooler in such a way that they do not touch.
- Put VOC vials in recloseable plastic bags and place them in the center of the cooler.
- Put ice in plastic bags and place in cooler on and around bottles, especially on VOC vials (including enough ice to keep the cooler at approximately 4°C).
- Fill cooler with packing material.
- Place the RFA and COC Record in plastic bags and attach to the inside of the cooler lid with masking tape or duct tape.
- Tape drain on cooler shut.
- Close cooler and secure lid by taping cooler completely around with strapping tape at two location.
- Place laboratory's address on top of cooler.
- Put "This Side Up" and "Fragile" labels on the cooler. (CAUTION: Do not cover labels with strapping tape.)
- Affix custody seals on front right and back left of cooler; cover seals with wide, clear tape.

While awaiting packaging, samples will be stored on ice in coolers. All samples will be collected in pre-preserved containers or preserved at the time of sample collection. Samples will not be preserved in the laboratory after collection. If samples cannot be shipped on the same day that they would be packaged, packaging will be delayed until the following morning so that the samples can be shipped with a full load of ice. Such samples will be stored on ice in coolers and kept in a secure area.

After the samples have been packaged for shipping, the coolers will be shipped to the laboratory via overnight courier. Upon shipment of the samples, the laboratory will be notified that a sample shipment is scheduled to arrive. An effort will be made to provide the laboratory with a one-week advance notice of sample shipment. Samples will not be collected on Friday's without prior laboratory approval for sample receipt on Saturdays.

Following its receipt of the samples, the laboratory will inspect and verify the samples and complete a "Cooler Receipt Form" as to the number and condition of samples shipped to it.

Table 1
Laboratory Analysis Parameters

Test	Method	Field Samples	Number of Field QC Duplicate Samples	Lab QC Samples	Field QC Triplicate Samples	Sample Container	Preservative
VOA	SW-846[a] 8240	9	1 + (3 trip blank)	3	1	3 x 40 ml VOA clear glass	HCl to pH<2
Semi-VOA	SW-846[a] 8270	9	1	3	1	2 x 1 liter amber glass or 1 x 2.5 liter amber glass	None
Metals (8 heavy metals)	SW-846[a] 6000 & 7000 series	9	1	2	1	1 x 1 liter plastic	HNO_3 to pH<2
Nitrate/Nitrite	LACHAT[b] 10-107-04-1A or MCAWW 353.2	9	1	2	1	1 x 1 liter plastic	H_2SO_4 to pH<2
Sulfate	MCAWW[c] 375.2	9	1	2	1	1 x 1 liter plastic	None Cool to 4°C
Chloride	MCAWW[c] 325.3	9	1	2	1	1 x 1 liter plastic	None Cool to 4°C
Alkalinity	MCAWW[c] 310.1	9	1	2	1	1 x 1 liter plastic	None Cool to 4°C
BOD	SM[d] 507	9	1	1	1	1 x 1 liter plastic	None Cool to 4°C
COD	MCAWW[c] 410.1	9	1	1	1	1 x 1 liter plastic	H_2SO_4 to pH<2
Settleable Solids	SM[d] 209E	9	1	0	1	1 x 1 liter plastic	None Cool to 4°C
TSS	MCAWW[c] 160.1	9	1	0	1	1 x 1 liter plastic	None Cool to 4°C
TDS	MCAWW[c] 160.2	9	1	0	1	1 x 1 liter plastic	None Cool to 4°C

[a]Test Methods for Evaluating Solid Waste. Physical Chemical Methods, U.S. EPA SW-846, 3rd Revised Edition, November 1986.
[b]Quick Chem Method, LACHAT Instruments, 1987.
[c]Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983.
[d]Standards Methods for the Examination of Water and Wastewater, 17th ed., 1989.

Note:

1. Field QA Triplicate samples were shipped to USACE SWE Laboratory in Dallas, Texas
2. One Trip Blank by cooler containing aqueous volatile samples
3. 8 heavy metals include: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

Table 2
Field Sampling Equipment Calibration Frequencies

Instrument	Frequency
pH Meter	Prior to each shift or as needed
Specific Conductance Meter	Prior to each shift or as needed
Organic Vapor Analyzer	Prior to each shift or as needed
Thermometer	Factory set
Electronic Water Level Meter	Twelve months
Level Head Indicator	Twelve months

Notes:

1. Calibration procedures will be followed as specified by the manufacturer.
2. Operations manuals will be kept on site with the field sampling equipment.

DRAFT

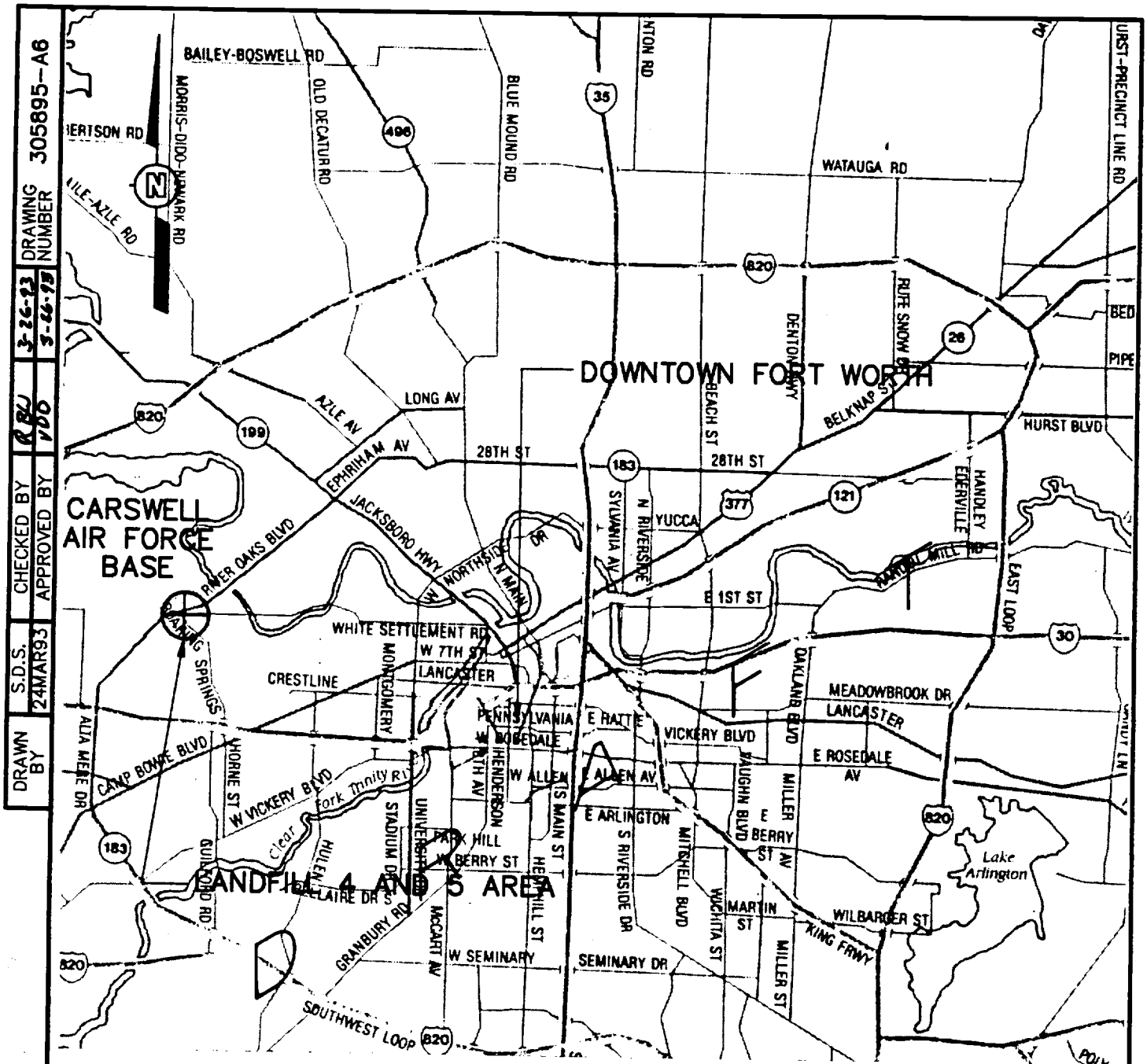


FIGURE 1
SITE LOCATION MAP

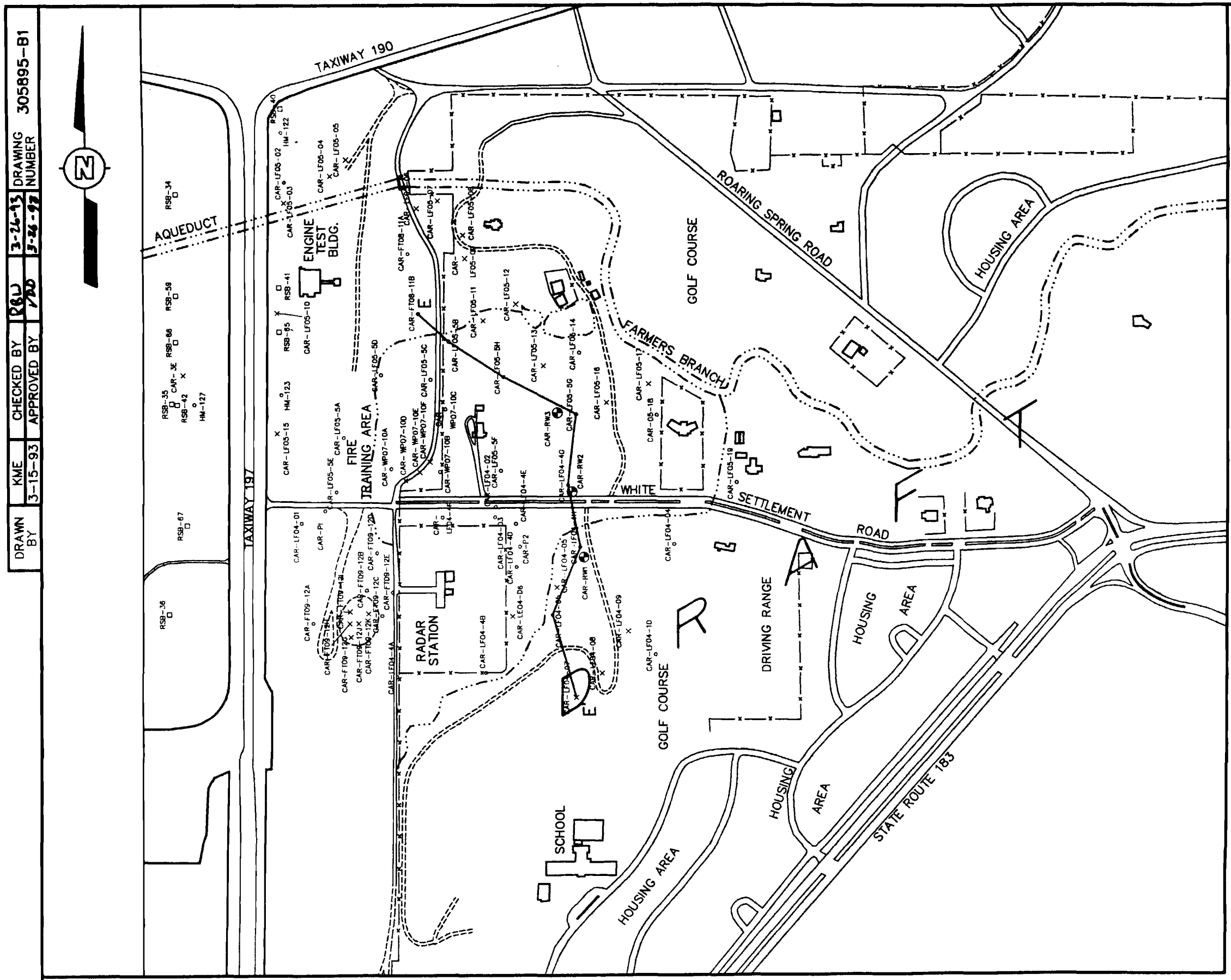
PREPARED FOR

U.S. AIR FORCE PLANT #4 (CARSWELL)
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

132298

DRAWN BY	KME	CHECKED BY	RBW	3-26-93	DRAWING NUMBER	305895-B1
	3-15-93	APPROVED BY	PBD	3-26-93		



LEGEND:

- ROAD
- STREAM
- FENCE
- HM-123 — MONITORING WELL
- CAR-LF04-10 — SOIL BORING
- CAR-RW1 — PROPOSED RECOVERY WELL
- E'——E LOCATION OF RADIAN CORP. CROSS SECTION (FIGURE 3)

SCALE

0 500 1000 FEET

FIGURE 2

PROPOSED RECOVERY WELLS
LANDFILLS 4 AND 5

PREPARED FOR

U. S. AIR FORCE PLANT #4 (CARSWELL)
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

132298

03-25-93
7:10 PM

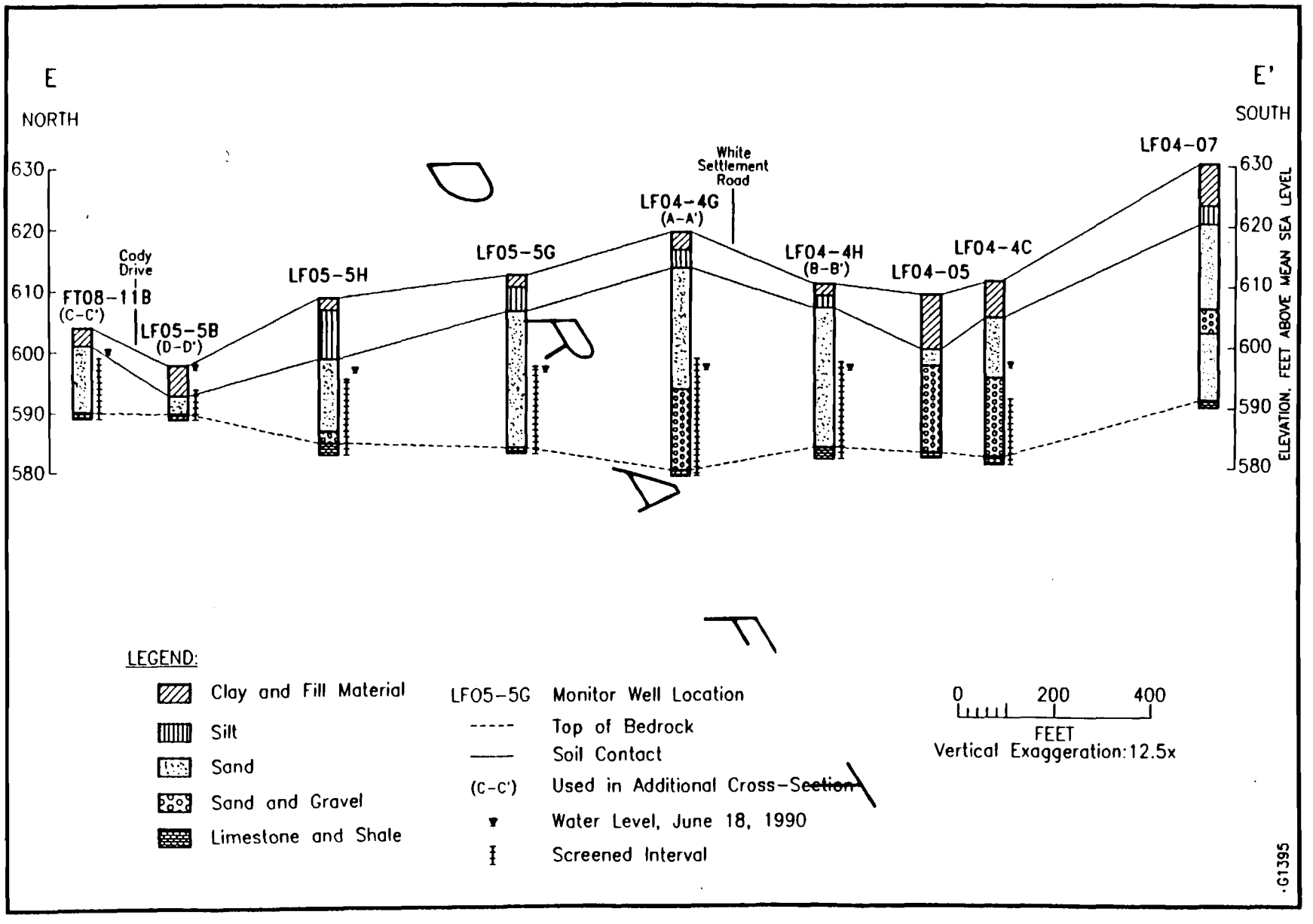


Figure 3 - **Geologic Cross-Section E-E', Flightline Area, Carswell AFB, Texas**
(Figure 3-9 from Radian Corporation RI Report, October 1991)

APPENDIX A
FIELD DOCUMENTATION FORMS

Project Name _____
Project No. _____
Project Manager _____

FIELD PROGRAM SUMMARY FOR_____
(Task Item)

ATTENDEES

OBJECTIVE (Purpose of Work)

CLIENT CONTACT (Name and Telephone Numbers)

TYPE OF PROGRAM (Sampling, Drilling, Well Measurements, etc.)

Specific Requirements (e.g., number of wells, test boreholes, sequence depth, etc.). Have boring locations been approved by the client in reference to location of underground utilities, tanks, etc.?

Required Materials/Equipment

Health and Safety (Equipment/Procedures)

JOB LOCATION/START DATE (Attach Map or Directions, if Necessary)

(Use Attachments, as Necessary)

Project Name _____
Project No. _____
Project Manager _____

SUBCONTRACTOR (Name, Attach Contract and/or Purchase Order Number)

REQUIRED FIELD FORMS (Chain-of-Custody, Field Activity Daily Log, etc.)

ANALYTICAL PROGRAM (Description, Tests, and Detection Limits Documentation)

CALIBRATION REQUIRED (Including Documentation)

BUDGET (Estimated Costs for this Activity)

POTENTIAL PROBLEMS THAT COULD OCCUR

CALL IN (IT Contact and Telephone Number)

Approved by _____ (Project Manager)

(Use Attachments, as Necessary)

INTERNATIONAL TECHNOLOGY CORPORATION

DAILY LOG				
	DATE			
	NO.			
	SHEET		OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	

DRAFT

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
IT PERSONNEL ON SITE:	
SIGNATURE	DATE:

INTERNATIONAL TECHNOLOGY CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER:	PROJECT NAME:	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS:		PAGE OF

DEPTH ( )	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER ( )	RECOVERY ( )	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	WELL CONSTRUCTION	REMARKS
				DRAFT				

NOTES:

Drilling Contractor _____

Drilling Equipment _____

Driller: _____

_____

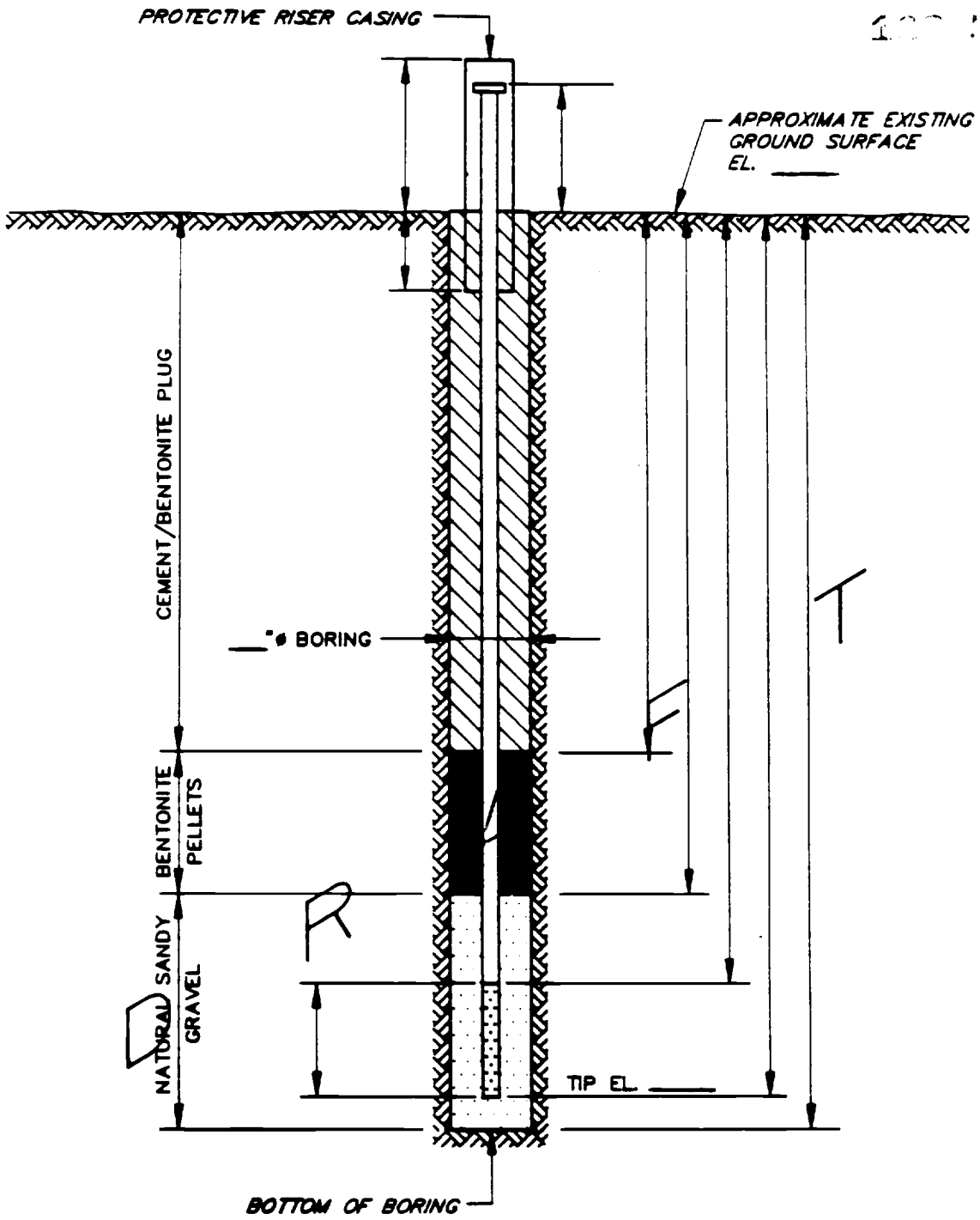
Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET OF SHEETS

1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING	%
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

DRAFT



NOTES:

1. RISER PIPE IS __ IN. I.D. _____ PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS __ IN. I.D. SST PIPE CONTINUOUS SLOT SCREEN (____ IN. SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL _____
5. WATER LEVEL READING ON _____

INSTALLATION DETAILS
MONITORING WELL ____

PREPARED FOR

_____

_____

IT INTERNATIONAL TECHNOLOGY CORPORATION

"NOT TO SCALE"

DRAWING NUMBER

CHECKED BY | APPROVED BY

DRAWN BY | 17JUL'89

65300

INTERNATIONAL TECHNOLOGY CORPORATION

MONITORING WELL DEVELOPMENT RECORD

103 51

Project Name: _____ Project No.: _____

Well No.: _____ Date Developed: _____

Field Personnel: _____

Weather Conditions: _____

Well Development Method: _____

Total Well Depth:	Time Started:
Depth to Water Table:	Time Completed:
Height of Water Column:	Notes:
Well Diameter:	
Well Volume:	

Well Volume Removed	Temperature	pH	Specific Conductance	Turbidity
Initial Reading				

Comments: _____

Prepared by: _____

Signature: _____

Date: _____

INTERNATIONAL TECHNOLOGY CORPORATION

VARIANCE NO. 100 52

VARIANCE LOG

PROJECT NO. _____ PAGE ___ OF ___

PROJECT NAME _____ DATE: _____

VARIANCE (INCLUDE JUSTIFICATION)

DRAFT

APPLICABLE DOCUMENT:

CC:

REQUESTED BY: _____ Date: _____

Approved By: _____ Date: _____
Project Manager

_____ Date: _____
Quality Assurance Officer

_____ Date: _____

INTERNATIONAL TECHNOLOGY CORPORATION

NONCONFORMANCE REPORT

PROJECT NO. _____ PAGE ___ OF ___

PROJECT NAME _____ DATE: _____

NONCONFORMANCE:

IDENTIFIED BY: _____ DATE: _____

CORRECTIVE ACTION REQUIRED:

TO BE PERFORMED BY: _____ DATE: _____

MUST CORRECTION BE VERIFIED? YES ___ NO ___

TO BE VERIFIED BY: _____ PREPARED BY: _____ DATE: _____

CORRECTIVE ACTION TAKEN:

PERFORMED BY: _____ DATE: _____

VERIFIED BY: _____ DATE: _____

cc:

Approved By: _____ Date: _____

_____ Date: _____

TAILGATE SAFETY MEETING

Division/Subsidiary _____ Facility _____

Date _____ Time _____ Job Number _____

Customer _____ Address: _____

Specific Location _____

Type of Work _____

Chemicals Used _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____

Chemical Hazards _____

Physical Hazards _____

Emergency Procedures _____

(ital / Clinic _____ Phone ( ) _____ Paramedic Phone ( ) _____

Hospital Address _____

Special Equipment _____

Other _____

ATTENDEES

NAME PRINTED	SIGNATURE

ting conducted by:

NAME PRINTED _____ SIGNATURE _____

Supervisor _____ Manager _____

36-8-85

INTERNATIONAL TECHNOLOGY CORPORATION

DATE						
TIME						
PAGE ____ OF ____						
PAGE						
PROJECT NO.						

SAMPLE COLLECTION LOG

PROJECT NAME _____

SAMPLE NO. _____

SAMPLE LOCATION _____

SAMPLE TYPE _____

COMPOSITE ____ YES ____ NO

COMPOSITE TYPE _____

DEPTH OF SAMPLE _____

WEATHER _____

CONTAINERS USED	AMOUNT COLLECTED

COMMENTS:

DRAFT

PREPARED BY: _____

ITE... TIO...
T... NOLOGY
C... ORATION

ANALYSIS REQUEST AND CHAIN OF CUST(Y RECORD *

Reference Document No. 044041
Page 1 of ___

Project Name/No. [1]
Sample Team Members [2]
Profit Center No. [3]
Project Manager [4]
Purchase Order No. [6]
Required Report Date [11]

Samples Shipment Date [7]
Lab Destination [8]
Lab Contact [9]
Project Contact/Phone [12]
Carrier/Waybill No. [13]

Bill to: [5]

Report to: [10]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive (mos.)

Turnaround Time Required: [26]
Normal ☐ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by [28] (Signature/Affiliation)	Date: Time:	1. Received by [28] (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

MCA 3/15/91

...bany samples
Yellow: Field copy
*See back of form for special instructions.

I[illegible]NATIONAL
T[illegible]NOLOGY
CORPORATION

ANALYSIS RE[illegible]EST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] _____
Page____of ____

Project Name | Project No. | Samples Shipment Date

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
			D					
				D				
					D			
						T		
						T		

White: To accompany samples Yellow: Field copy

*See back of form for special instructions

MCA 3/15/91

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE